

WHAT IS CLAIMED IS:

1. A method for generating an image matrix, comprising:

accessing a round-trip time matrix for a space comprising a plurality of points, the round-trip time matrix describing an estimated round-trip time for a signal of a plurality of signals to travel from a transmit antenna of one or more transmit antennas, to a point of the plurality of points, and to a receive antenna of one or more receive antennas;

receiving the plurality of signals reflected from an object of the space, each signal received at a corresponding receive antenna of the one or more receive antennas;

repeating for at least a subset of the plurality of points to generate an image matrix comprising an image value for each point of the subset of points:

selecting a point of the subset of points;

repeating for each receive antenna of the one or more receive antennas:

establishing a waveform of a signal received by a receive antenna of the one or more receive antennas; and

identifying a waveform value of the established waveform that corresponds to the selected point according to the round-trip time matrix; and

combining the waveform values for the selected point to yield an image value for the selected point; and  
generating the image matrix from the image values.

2. The method of Claim 1, wherein identifying the waveform value of the established waveform that corresponds to the selected point according to the round-trip time matrix further comprises:

5 determining a waveform point of the established waveform that corresponds to the estimated round-trip time corresponding to the selected point and the receive antenna; and

10 taking the waveform value of the waveform at the determined waveform point.

3. The method of Claim 1, further comprising scaling the waveform values of the waveforms by:

15 accessing a range-amplitude correction matrix comprising a plurality of correction values, a correction value corresponding to a waveform point of a waveform; and

20 adjusting the waveform values of the waveform points of the waveforms in accordance with the plurality of correction values.

4. The method of Claim 1, further comprising reducing a background of the waveforms by:

25 determining one or more background measurements for each waveform; and

subtracting the one or more background measurements from the waveforms.

5. The method of Claim 1, further comprising reducing interference by:

detecting a plurality of interfering signals of the plurality of signals;

5 filtering out the interfering signals; and

amplifying a plurality of pulses of the plurality of signals.

10 6. The method of Claim 1, further comprising generating an averaged image matrix to display a stationary target by:

generating a plurality of successive image matrices; and

15 averaging the image values of the successive image matrices to yield the averaged image matrix to display the stationary target.

7. The method of Claim 1, further comprising identifying a moving target by:

20 generating a plurality of successive image matrices;

detecting a difference between two successive image matrices;

determining a portion of the successive image matrices corresponding to the difference; and

25 identifying the portion as the moving target.

8. The method of Claim 1, wherein at least one of the one or more transmit antennas and the one or more receive antennas comprises a coaxial cavity antenna.

9. The method of Claim 1, further comprising transmitting the plurality of signals from the one or more transmit antennas.

5 10. The method of Claim 1, wherein the plurality of signals comprises one or more polarized signals.

11. A method for generating an image matrix, comprising:

a memory operable to store a round-trip time matrix for a space comprising a plurality of points, the round-trip time matrix describing an estimated round-trip time for a signal of a plurality of signals to travel from a transmit antenna of one or more transmit antennas, to a point of the plurality of points, and to a receive antenna of one or more receive antennas;

one or more receive antennas operable to receive the plurality of signals reflected from an object of the space, a receive antenna of the one or more receive antennas being operable to receive a corresponding signal; and

an image generator operable to:

repeat for at least a subset of the plurality of points to generate an image matrix comprising an image value for each point of the subset of points:

select a point of the subset of points;

repeat for each receive antenna of the one or more receive antennas:

establish a waveform of a signal received by a receive antenna of the one or more receive antennas; and

identify a waveform value of the established waveform that corresponds to the selected point according to the round-trip time matrix; and

combine the waveform values for the selected point to yield an image value for the selected point; and

generate the image matrix from the image values.

12. The system of Claim 11, the image generator further operable to identify the waveform value of the established waveform that corresponds to the selected point according to the round-trip time matrix by:

determining a waveform point of the established waveform that corresponds to the estimated round-trip time corresponding to the selected point and the receive antenna; and

taking the waveform value of the waveform at the determined waveform point.

13. The system of Claim 11, the image generator further operable to scale the waveform values of the waveforms by:

accessing a range-amplitude correction matrix comprising a plurality of correction values, a correction value corresponding to a waveform point of a waveform; and

adjusting the waveform values of the waveform points of the waveforms in accordance with the plurality of correction values.

14. The system of Claim 11, the image generator further operable to reduce a background of the waveforms by:

determining one or more background measurements for each waveform; and

subtracting the one or more background measurements from the waveforms.

15. The system of Claim 11, the image generator further operable to reduce interference by:

detecting a plurality of interfering signals of the plurality of signals;

5 filtering out the interfering signals; and

amplifying a plurality of pulses of the plurality of signals.

10 16. The system of Claim 11, the image generator further operable to generate an averaged image matrix to display a stationary target by:

generating a plurality of successive image matrices; and

15 averaging the image values of the successive image matrices to yield the averaged image matrix to display the stationary target.

17. The system of Claim 11, the image generator further operable to identify a moving target by:

20 generating a plurality of successive image matrices;

detecting a difference between two successive image matrices;

determining a portion of the successive image matrices corresponding to the difference; and

25 identifying the portion as the moving target.

18. The system of Claim 11, wherein at least one of the one or more transmit antennas and the one or more receive antennas comprises a coaxial cavity antenna.

19. The system of Claim 11, further comprising the one or more transmit antennas operable to transmit the plurality of signals.

5        20. The system of Claim 11, wherein the plurality of signals comprises one or more polarized signals.



/ 21. Logic for generating an image matrix, the logic embodied in a computer-readable medium and operable to:

access a round-trip time matrix for a space comprising a plurality of points, the round-trip time matrix describing an estimated round-trip time for a signal of a plurality of signals to travel from a transmit antenna of one or more transmit antennas, to a point of the plurality of points, and to a receive antenna of one or more receive antennas;

receive the plurality of signals reflected from an object of the space, each signal received at a corresponding receive antenna of the one or more receive antennas;

repeat for at least a subset of the plurality of points to generate an image matrix comprising an image value for each point of the subset of points:

select a point of the subset of points;

repeat for each receive antenna of the one or more receive antennas:

establish a waveform of a signal received by a receive antenna of the one or more receive antennas; and

identify a waveform value of the established waveform that corresponds to the selected point according to the round-trip time matrix; and

combine the waveform values for the selected point to yield an image value for the selected point; and generate the image matrix from the image values.

22. The logic of Claim 21, further operable to identify the waveform value of the established waveform that corresponds to the selected point according to the round-trip time matrix by:

5       determining a waveform point of the established waveform that corresponds to the estimated round-trip time corresponding to the selected point and the receive antenna; and

10       taking the waveform value of the waveform at the determined waveform point.

23. The logic of Claim 21, further operable to scale the waveform values of the waveforms by:

15       accessing a range-amplitude correction matrix comprising a plurality of correction values, a correction value corresponding to a waveform point of a waveform; and

20       adjusting the waveform values of the waveform points of the waveforms in accordance with the plurality of correction values.

24. The logic of Claim 21, further operable to reduce a background of the waveforms by:

25       determining one or more background measurements for each waveform; and

      subtracting the one or more background measurements from the waveforms.

25. The logic of Claim 21, further operable to reduce interference by:

detecting a plurality of interfering signals of the plurality of signals;

5 filtering out the interfering signals; and

amplifying a plurality of pulses of the plurality of signals.

26. The logic of Claim 21, further operable to  
10 generate an averaged image matrix to display a stationary target by:

generating a plurality of successive image matrices;  
and

15 averaging the image values of the successive image matrices to yield the averaged image matrix to display the stationary target.

27. The logic of Claim 21, further operable to identify a moving target by:

20 generating a plurality of successive image matrices;

detecting a difference between two successive image matrices;

determining a portion of the successive image matrices corresponding to the difference; and

25 identifying the portion as the moving target.

28. The logic of Claim 21, wherein at least one of the one or more transmit antennas and the one or more receive antennas comprises a coaxial cavity antenna.

29. The logic of Claim 21, further operable to transmit the plurality of signals from the one or more transmit antennas.

5           30. The logic of Claim 21, wherein the plurality of signals comprises one or more polarized signals.

31. A system for generating an image matrix,  
comprising:

means for accessing a round-trip time matrix for a  
space comprising a plurality of points, the round-trip  
time matrix describing an estimated round-trip time for a  
signal of a plurality of signals to travel from a  
transmit antenna of one or more transmit antennas, to a  
point of the plurality of points, and to a receive  
antenna of one or more receive antennas;

means for receiving the plurality of signals  
reflected from an object of the space, each signal  
received at a corresponding receive antenna of the one or  
more receive antennas;

means for repeating for at least a subset of the  
plurality of points to generate an image matrix  
comprising an image value for each point of the subset of  
points:

selecting a point of the subset of points;

repeating for each receive antenna of the one  
or more receive antennas:

establishing a waveform of a signal  
received by a receive antenna of the one or more receive  
antennas; and

identifying a waveform value of the  
established waveform that corresponds to the selected  
point according to the round-trip time matrix; and

combining the waveform values for the selected  
point to yield an image value for the selected point; and

means for generating the image matrix from the image  
values.

32. A method for generating an image matrix, comprising:

accessing a round-trip time matrix for a space comprising a plurality of points, the round-trip time matrix describing an estimated round-trip time for a signal of a plurality of signals to travel from a transmit antenna of one or more transmit antennas, to a point of the plurality of points, and to a receive antenna of one or more receive antennas, at least one of the one or more transmit antennas and the one or more receive antennas comprising a coaxial cavity antenna, the plurality of signals comprising one or more polarized signals;

receiving the plurality of signals reflected from an object of the space, each signal received at a corresponding receive antenna of the one or more receive antennas;

repeating for at least a subset of the plurality of points to generate an image matrix comprising an image value for each point of the subset of points:

selecting a point of the subset of points;

repeating for each receive antenna of the one or more receive antennas:

establishing a waveform of a signal received by a receive antenna of the one or more receive antennas;

reducing a background of the waveform by determining one or more background measurements for the waveform, and subtracting the one or more background measurements from the waveform;

reducing interference by repeating the following: detecting a plurality of interfering signals of the plurality of signals, filtering out the interfering signals, and amplifying a plurality of pulses  
5 of the plurality of signals;

identifying a waveform value of the established waveform that corresponds to the selected point according to the round-trip time matrix by:

determining a waveform point of the  
10 established waveform that corresponds to the estimated round-trip time corresponding to the selected point and the receive antenna; and

taking the waveform value of the waveform at the determined waveform point;

15 scaling the waveform value by accessing a range-amplitude correction matrix comprising a plurality of correction values, a correction value corresponding to a waveform point of the waveform, and adjusting the waveform value in accordance with the plurality of  
20 correction values; and

combining the waveform values for the selected point to yield an image value for the selected point; and

25 generating the image matrix from the image values;

generating an averaged image matrix to display a stationary target by generating a plurality of first successive image matrices, and averaging the image values of the first successive image matrices to yield the  
30 averaged image matrix to display the stationary target; and

identifying a moving target by generating a plurality of second successive image matrices, detecting a difference between two second successive image matrices, determining a portion of the second successive  
5 image matrices corresponding to the difference, and identifying the portion as the moving target.